

REMARKS

This Amendment is filed in response to the Office Action mailed September 23, 2009. All objections and rejections are respectfully traversed.

Claims 23-54 are in the case.

No new claims have been added.

Claims 23, 26, 29, 31, and 38-53 have been amended to better claim the invention.

Interview Summary

Applicant would like to thank Examiner Wassum for conducting the Applicant Initiated Interview on November 16, 2009 and for helping to advance this Application closer to allowance. Generally, as will be elaborated upon in greater detail below, the issue discussed involved Applicant's use of **copy[ing] one or more bytes of the particular range of data bytes *from the snapshot storage device* to the destination storage device in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device.** Specifically, Applicant discussed that while Ofek teaches a source, a destination, and copying data from a specific location on the source to the destination, Applicant claims, broadly stated, the option of copying data to a destination device from either a specific location on the source (i.e., in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has not already been written from the source to the snapshot storage device) or ***from the snapshot storage device* to the destination storage device (i.e., in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device).** While Examiner initially agreed with Applicant, Examiner noted that a closer look at the references would be required to verify Applicant's contentions and that another search would be required. Examiner is encouraged to contact the undersigned attorney with any questions.

Claim Objections

At paragraph 6 of the Office Action, claim 26 was objected to because of an informality. Claim 26 has been amended and is believed to be in condition for allowance.

Rejections Under 35 U.S.C. §102

At paragraph 10 of the Office Action, claims 23, 26, 28-29, 31, 34, 36-37, 39-41, 45-46, 50-52, and 54 were rejected under 35 U.S.C. §102(b) as being unpatentable in view of Ofek et al., U.S. Patent Application Publication No. 2005/0204108 published on September 5, 2005 (hereinafter “Ofek”).

Applicant’s claimed novel invention, as set forth in representative claim 23, comprises in part:

23. A storage system, comprising:
 - a destination storage device configured to store a copy of data from a source storage device;
 - a snapshot storage device configured to store a snapshot version of the data from the source storage device;
 - a process configured to initiate a copy operation of the source storage device, wherein the copy operation is configured to copy each block of the source storage device to the destination storage device, and wherein the copy operation is performed in segments, and wherein each segment is a range of data bytes of the source storage device;
 - the storage system configured to receive a write request to modify a requested range of data bytes of the source storage device while the copy operation of the source storage device is in progress, wherein the write request to modify the requested range of data bytes is a write request range;
 - the storage system further configured to determine that the write request range falls within the range of data bytes of the source storage device being copied while the copy operation is in progress;
 - in response to determining that the write request range falls within the range of data bytes of the source storage device being copied while the copy operation is in progress, the storage system further configured to determine if a particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device;
 - in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the**

write request range has already been written to the snapshot storage device, the copy operation further configured to copy one or more bytes of the particular range of the range of data bytes *from the snapshot storage device to the destination storage device*, the process further configured to write the write request to the source storage device; and
in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has not already been written to the snapshot storage device, the process further configured to copy the particular range of the range of data bytes of the source storage device to the snapshot storage device, the process further configured to write the write request to the source storage device.

Ofek teaches data backup of a physical backup segment. Ofek teaches determining whether there has been an attempt (e.g., a hit) to write to a physical backup segment of a backup segment set in an abstract block set [0247]. If a hit is received for the backup segment, the hit segment is copied (backed up) out of turn from the backup segment (i.e., the source) to a backup device before the source is overwritten [0247]. Notably, the backup segment is located on the source, as the backup segment is part of a logical object to be copied [0243].

Applicant respectfully urges that Ofek does not disclose Applicant's claimed novel **in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device, the copy operation further configured to copy one or more bytes of the particular range of the range of data bytes *from the snapshot storage device to the destination storage device*.**

Applicant claims receiving a write request to modify a particular range of data bytes of the source storage device while a copy operation of the source storage device is in progress. Applicant further claims determining if **the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to a snapshot storage device. If the particular range of the range of data bytes of the source storage device to be modified by the write request**

range has already been written to the snapshot storage device, Applicant claims, *in response*, **a copy operation configured to copy one or more bytes of the particular range of the range of data bytes** *from the snapshot storage device to the destination storage device*. For example, this would be in contrast from copying the one or more bytes of the particular range of data bytes directly from the active file system of the source storage device.

Applicant respectfully contends that Ofek does not show Applicant's claimed novel **in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device, the copy operation further configured to copy one or more bytes of the particular range of the range of data bytes** *from the snapshot storage device to the destination storage device*. Specifically, Ofek teaches that if such a particular range of data currently undergoing a copy operation is also in the process of being written to (e.g., an overlapping range of data), then that particular range of data is copied directly from the source device to the destination device before allowing the write operation to progress (i.e., overwrite the source data being copied with the new data). In contrast, Applicant claims that in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written (from the source device) to a snapshot storage device, a copy operation is configured to copy the bytes of the particular range of data bytes *from the snapshot storage device to the destination storage device*.

In other words, while Ofek teaches a source, a destination, and copying data from a specific location on the source to the destination, Applicant claims, broadly stated, the option of copying data to a destination device from either a specific location on the source (i.e., in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has not already been written from the source to the snapshot storage device) or *from the snapshot storage device* to the destination storage device (i.e., **in response to determining that the particular range of the range of data bytes of the source storage device to be modi-**

fied by the write request range has already been written to the *snapshot storage device*). As such, because Ofek does not disclose the option of copying the particular range of data currently undergoing a copy operation which is also receiving a write request (e.g., the overlapping range of data) *from a snapshot*, Ofek is silent to Applicant's claimed novel **in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device, the copy operation further configured to copy one or more bytes of the particular range of the range of data bytes from the snapshot storage device to the destination storage device.**

As a side note, while Ofek may or may not show copying or restoring data from a snapshot to a destination, Applicant respectfully notes that Ofek does not teach this action **in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device.** Additionally, while Ofek may or may not show copying a segment to a cache and then later copying the cache to a destination (see Ofek at paragraph 0248), Applicant respectfully notes that Ofek's cache is not the same as Applicant's claimed *snapshot storage device*, nor does Ofek teach this action **in response to determining that the particular range of the range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device.**

Accordingly, Applicant respectfully urges that the Ofek publication is legally precluded from anticipating the claimed invention under 35 U.S.C. §102 because of the absence from the Ofek publication of Applicant's claimed novel **in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device, the copy operation further configured to copy one or more bytes of the particular range of the range of data bytes from the snapshot storage device to the destination storage device.**

Applicant's Interpretation of the Prior Art

Applicant's interpretation of Ofek was derived, in part, from the following excerpts:

[0243] At a step 192, those physical backup segments that contain data from the logical object are marked for copying. This may be done in a number of ways. For example, a bit may be associated with each potential physical backup segment in the system. The bit may be set to a "one" if the corresponding physical backup segment is part of a logical object to be copied. Of course, the methods for identifying the physical backup segments that are part of the abstract block set being copied can be used. As just one example, a list of the physical backup segments could be maintained.

[0247] At a step 194, it is determined whether there is a hit on a physical backup segment that is included in the backup segment set in the abstract block set. If so, that segment is copied out of turn--and before the update is made. After the segment has been copied, that segment can be unmarked--further updates may be allowed for that segment. After the segment has been unmarked, the update may be performed. Processing will then continue at step 194 in case there are additional hits (attempts to write to) a physical backup segment included in the abstract block set.

[0248] The copying of the segment may occur directly to the target (receiving primary storage element or receiving the secondary storage element such as a tape) or may be copied to a cache for later copying to the target destination of the abstract block set.

[0252] In situations where the physical backup segment granularity is larger than the physical data block size, a write may occur to a physical backup segment that does not correspond to a write to a logical object. For example, consider a physical backup segment that has one physical data block that is in the logical object that is being backed up and three other physical data blocks that belong to other logical objects. A write to one of the physical data blocks corresponding to different logical object would trigger backup of the physical data segment, even though the logical object being backed up is not being updated.

Claim Support

Any currently pending claim(s) are believed to be in condition for allowance and fully supported by Applicant's specification, as may be shown by the exemplary cita-

tion(s) further below. Upon request, additional citations may be provided for additional support.

With reference to the claim(s), support may be found at Specification page 13, lines 3-5:

If bytes have been snapshot (step 358), it substitutes volume bytes with snapshot bytes from the snapshot volume (step 360).

With reference to the claim(s), support may be found at Specification page 13, lines 10-13:

If bytes within the copy write range have changed, then the bytes in the snapshot volume are used in the volume in the data stream to the target device.

Rejections Under 35 U.S.C. §103

At paragraph 29 of the Office Action claim 49 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ofek in view of Smith et al., U.S. Patent No. 5,241,631 (hereinafter “Smith”).

Applicant’s claimed novel invention, as set forth in representative claim 49, comprises in part:

49. A computer-readable storage media containing executable program instructions executed by a processor, comprising:

program instructions that receive at a source storage device a write request issued from a storage system, the write request specifying a first range of data bytes of the source storage device, the write request being received while the source storage device is being copied to a destination storage device;

in response to receiving the write request, program instructions that hold the write request in a cache;

program instructions that check if the first range overlaps with a particular range of the range of data bytes of the source storage device to be modified by the write request that is being copied to the destination storage device;

program instructions that determine if the particular range of the range of data bytes of the source storage device to be modified by the write request has already been written to a snapshot storage device;

in response to the first range overlapping with the particular range of data bytes of the source storage device to be modified by the write request already having been written to the snapshot storage device, program instructions that copy one or more bytes of the particular range of data bytes *from the snapshot storage device* to the destination device;

program instructions that update a snapshot map; and

program instructions that allow the write request to write to the source storage device.

Smith teaches, in relevant part as cited by Examiner, a first in first out buffer (col. 17, lines 11-26). However, Smith is silent to Applicant's claimed novel **in response to the first range overlapping with the particular range of data bytes of the source storage device to be modified by the write request already having been written to the snapshot storage device, program instructions that copy one or more bytes of the particular range of data bytes *from the snapshot storage device* to the destination device.**

Additionally, as noted above, Ofek also does not disclose or teach Applicant's claimed novel **in response to determining that the particular range of the range of data bytes of the source storage device to be modified by the write request range has already been written to the snapshot storage device, the copy operation further configured to copy one or more bytes of the particular range of the range of data bytes *from the snapshot storage device* to the destination storage device.** As such, because claim 49 comprises similar limitations not shown by either prior art reference, Applicant respectfully urges that Ofek, taken singly or in any combination with Smith, is legally insufficient to render the presently claimed invention obvious under 35 U.S.C. §103(a). Specifically, Ofek and Smith, taken singly or in any combination, does not disclose Applicant's claimed novel and non-obvious use of **in response to the first range overlapping with the particular range of data bytes of the source storage device to be modified by the write request already having been written to the snapshot storage device,**

program instructions that copy one or more bytes of the particular range of data bytes from the snapshot storage device to the destination device.

At paragraph 31 of the Office Action, claims 24 and 32 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ofek as applied to claims 23, 26, 28, 29, 31, 34, 36, 37, 39- 41, 45-46, 50-52, and 54.

At paragraph 33 of the Office Action claims 25, 33, and 47-48 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ofek in view of Smith.

At paragraph 36 of the Office Action, claims 27-35 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ofek as applied to claims 23, 26, 28, 29, 31, 34, 36, 37, 39-41, 45-46, 50-52, and 54 above, in view of Tawil, U.S. Patent No. 6,421,723.

At paragraph 38 of the Office Action, claims 30 and 38 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ofek as applied to claims 23, 26, 28, 29, 31, 34, 36, 37, 39-41, 45-46, 50-52, and 54 above, in view of Dulai et al., U.S. Patent No. 6,205,479.

At paragraph 40 of the Office Action, claims 42-44 were rejected under 35 U.S.C. §103(a) as being unpatentable over Ofek as applied to claims 23, 26, 28, 29, 31, 34, 36, 37, 39-41, 45-46, 50-52, and 54 above, in view of Simpson et al., U.S. Patent No. 6,128,306.

At paragraph 42 of the Office Action, claim 53 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ofek as applied to claims 23, 26, 28, 29, 31, 34, 36, 37, 39-41, 45-46, 50-52, and 54 above, in view of Osterman et al., U.S. Patent No. 5,867,650.

The claims rejected by Examiner at paragraphs 31, 33, 36, 38, 40, and 42 are dependent claims that are dependent from independent claims which are believed to be allowable for the reasons described above. Accordingly, the claims rejected by Examiner at paragraphs 31, 33, 36, 38, 40, and 42 are believed to be in condition for allowance.

Conclusion

All new claims and/or claim amendments are believed to be fully supported by Applicant's specification.

All independent claims are believed to be in condition for allowance.

All dependent claims are believed to be dependent from allowable independent claims, and therefore in condition for allowance.

Favorable action is respectfully solicited.

Please charge any additional fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

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